CARLSON ENVIRONMENTAL CONSULTANTS, PC

LANDFILL GAS AND SOLID WASTE SPECIALISTS

March 3, 2021

Jennifer Vogel, Environmental Engineer
RCRA Programs and Cleanup Branch
Land, Chemicals and Redevelopment Division
EPA-Region 4
61 Forsyth Street, SW
Atlanta, GA 30303

RE: Request for Determination
Lamar County Solid Waste Authority, Lamar County, Georgia
Proposed Pyrolysis, Gas Processing, & Leachate Evaporation System

Dear Ms. Vogel:

On behalf of the Lamar County Regional Solid Waste Authority (LCRSWA), Carlson Environmental Consultants, PC (CEC) requests a determination regarding an electric pyrolysis, gas processing, and leachate evaporation system that LCRSWA proposes to install at the Cedar Grove Landfill in Lamar County, Georgia. LCRSWA intends to produce synthesis gas (syngas) via electrically-powered pyrolysis of feedstock derived from municipal solid waste (MSW). The syngas will then be treated to remove contaminants in several gas processing steps. Once cleaned, the syngas will be used as fuel in boilers to provide indirect heat to evaporate landfill leachate.

We request a determination from EPA to confirm that the proposed system will produce and utilize a syngas fuel, and that combustion of the syngas fuel for the purpose of evaporating leachate will not constitute disposal of a solid waste. This request contains a summary of the proposed system and an analysis of each of the criteria established in EPA's non-hazardous secondary materials rule in 40 CFR Part 241.

I. General System Description

Leachate evaporation is a proven control technology and has many benefits relative to other methods of leachate disposal. However, most leachate evaporation systems rely on the combustion of raw landfill gas to power the evaporator, and some rely on a direct heat source. The proposed system will provide a more environmentally beneficial means for leachate evaporation by using treated syngas instead of raw landfill gas as the fuel for boilers that will provide an indirect heat source for the evaporation of the leachate.

The proposed system will include three pyrolysis units, several contaminant removal and pollution control systems, one syngas boiler (rated at approximately 75 MMBtu/hour), and one leachate evaporator. The pyrolysis units will be electrically powered and also referred to as "carbonizers." Each carbonizer will have the capacity to process up to 35 tons per day of MSW feedstock, which will be produced from as-received MSW via removal of recyclable and inert materials and resizing of the remaining material. With three carbonizers in a system, the entire system will be capable of processing 105 tons per day, and LCRSWA is evaluating the possibility of installing up to three such systems in different phases.

The carbonizers will begin the processing of the feedstock by electrically heating the material with little or no oxygen available to support combustion, which will convert the feedstock into a "make gas" stream and a solid char stream. The solid char stream will be mainly carbon with some inorganic minerals, metals, and sulfur that will be separated from the make gas stream and disposed or used/sold for beneficial purposes. With the removal of the char, the make gas stream will contain a reduced gas containing carbon monoxide, methane, hydrogen, lower molecular weight hydrocarbons (C2 to C10), and other particulates and condensables.

II. Gas Processing Steps

Following the processing associated with the carbonizer itself, further processing and treatment of the make gas will be completed in several steps. First, each of the three carbonizers will have a dedicated hot cyclone. Solids, including metals, will be removed in the cyclone and will fall via gravity to the cooling screws to be recombined with the char stream. The char will then be directed to the char handling area where it will be temporarily stored prior to being routed either to the landfill for disposal or to further processing for sale as a useful product. During start-up and unit trip, make gas from the carbonizers will be routed to an open flare, which will function as a pollution control device during those limited duration events.

A second gas clean-up system will be located downstream of the hot cyclones to remove heavier condensables and particulate from raw make gas through oil scrubbing followed by an electrostatic precipitation process. The gas effluent leaving this second system will be referred to as "product gas," which will have similar combustion characteristics to natural gas. The condensables and particulates removed from the make gas will be routed to a pollution control device rated at approximately 21 MMBtu/hour, and heat generated by that device will be used to generate a small amount of supplemental steam (~10% of the total heat used in the leachate evaporation process).

The product gas will then be routed to a third clean-up process—a sulfur scavenging system using a media such as Sulfatreat™ to remove inorganic sulfur compounds prior to combustion in the syngas boiler. Full scale testing has shown the product gas will likely contain approximately 100 parts per million by volume (ppmv) of hydrogen sulfide (H_2S) prior to treatment, which will be the dominant reduced sulfur component. Sulfatreat can remove up to 100% of the reduced sulfur compounds. However, like any scavenging media, its efficacy is reduced as the material becomes saturated. A lead-lag system will be installed to maintain a relatively consistent outlet concentration of 16 ppmv total reduced sulfur, consistent with EPA limits for compressed natural gas found in 40 CFR 79.55. Operating parameters of the treatment equipment will be monitored in accordance with an enforceable air permit to ensure the equipment performs as expected. For example, a sulfur treatment monitoring plan will be developed to help identify when media change-outs are needed.

The heat content of the fully treated syngas will vary depending upon feedstock composition, but based upon multiple samples obtained from similar full-scale pyrolysis units, the as-fired heat content of the syngas will likely be approximately 9,000 Btu/lb. The gas boiler will be designed to combust either or both natural gas or the syngas as needed, which confirms that the two fuels will be substantially similar. Additional emission control systems will be installed at the boiler exhaust to minimize post-combustion emissions consistent with the regulatory requirements for all boilers.

III. Non-Hazardous Secondary Materials Rule Criteria Review

The syngas will be the primary intended product of the carbonizers and gas processing equipment described above, and therefore it may not qualify as a "secondary material" at all but rather a

"traditional fuel," which is defined in 40 CFR 241.2 to include "synthetic fuel." Nevertheless, the following analysis assumes the syngas may be characterized as a non-hazardous secondary material to confirm that, even under the criteria relevant to secondary materials, combustion of the syngas qualifies as use of a non-waste fuel, not merely disposal of a solid waste.

Notably, the Final Rule preamble to 40 CFR Part 241 (76 FR 15549 (Mar. 21, 2011)) acknowledges that "[s]ynthesis gas (or syngas as it is commonly referred) produced from the gasification of solid waste is another material that can also meet the requirements of a fuel product produced from the processing of discarded nonhazardous secondary materials, provided the syngas has been adequately processed to remove contaminants." The preamble also states "[a]t a minimum, syngas cleanup generally includes removal of sulfur and metals. These two components (meaning the gasifier and cleanup system) work together producing a synthesis gas that can be used as a fuel …." Although this statement was made in the context of a discussion about the use of syngas in a combustion turbine, the underlying reasoning should apply equally regardless of the type of combustion unit fueled by the syngas. Syngas produced from the pyrolysis, as in the proposed system, is substantially similar to syngas produced by gasification of MSW in that it consists primarily of carbon monoxide, methane, hydrogen, and other hydrocarbons with a heat content substantially greater than unprocessed MSW.

To qualify as a non-waste fuel under Part 241, a discarded non-hazardous secondary material must first be "processed" consistent with the definition in 40 CFR 241.2. The resulting fuel must also meet the legitimacy criteria specified in 40 CFR 241.3(d)(1). The following discussion addresses both of these points.

Processing Criteria

Processing, as defined in 40 CFR 241.2, means any operations that transform discarded non-hazardous secondary material into a non-waste fuel or non-waste ingredient product. Processing includes, but is not limited to, operations necessary to: remove or destroy contaminants; significantly improve the fuel characteristics of the material, e.g., sizing or drying the material in combination with other operations; chemically improve the as-fired energy content; or improve the ingredient characteristics. Minimal operations that result only in modifying the size of the material by shredding do not constitute processing for purposes of this definition. The relevant portions of the definition are discussed separately below.

1. Remove or destroy contaminants

The syngas processing steps described above include (i) the carbonizer itself that separates out a solid char containing metals and sulfur, (ii) a hot cyclone for removing particulates and metals, (iii) an oil scrubbing and electrostatic precipitator to remove heavier condensables, and (iv) a sulfur scavenging system that will remove reduced sulfur. The system will also have two pollution control devices, a flare for use during start-up and unit trips to control gas when it cannot proceed through the control train and a control device for particulates and condensables separated by the oil scrubbing and electrostatic precipitator system that can be used to generate supplemental steam for leachate evaporation. These additional processing and contaminant removal steps provide a clear separation between the carbonization of the MSW feedstock and the combustion of the syngas generated by the carbonization process.

2. Significantly improve the fuel characteristics of the material

The carbonization of MSW described in Section I will create syngas rich in hydrocarbons similar to traditional fuels. The syngas processing steps described in Section II will further improve the fuel characteristics by removing particulate matter, excess moisture, and heavier condensable

hydrocarbons, rendering it cleaner burning and of a similar physical and chemical quality as natural gas.

3. Chemically improve the as-fired energy content

The syngas will have an as-fired heat content of approximately 9,000 Btu/lb, which is significantly higher than unprocessed MSW. The carbonization step chemically alters the MSW by volatilizing the waste into a hydrocarbon rich syngas stream. The treatment step to remove condensables and moisture further increases the heating value of the syngas.

Legitimacy Criteria

Once appropriately "processed," the resulting fuel must also meet the "legitimacy criteria" set forth in 40 CFR 241.3(d). Each of the legitimacy criteria for a fuel is discussed below.

1. 40 CFR 241.3(d)(1)(i) Managed as a valuable commodity

The fuel must be managed as a valuable commodity, in that its storage must not exceed a reasonable time and that it is managed consistent with analogous fuel or adequately contained. In this case, the syngas will be used immediately as it is produced, with no storage at all. The syngas will be used in lieu of other traditional fuels that may otherwise be used for the evaporation of leachate and serve a valuable purpose by essentially eliminating the need for treatment/disposal of the leachate in a waste water treatment plant.

2. 40 CFR 241.3(d)(1)(ii) Meaningful heating value and used as a fuel to recover energy.

EPA states in the preamble to the 40 CFR 241 that materials with an as-fired heating value of more than 5,000 Btu/lb are considered to have meaningful heat content. The syngas will have an as-fired heat content of approximately 9,000 Btu/lb and will be used to generate and recover energy for use in the evaporation of landfill leachate.

3. 40 CFR 241.3(d)(1)(iii) Contaminants at levels comparable to those in traditional fuels.

The processing steps above, including removal of sulfur down to a concentration of 16 ppmv, will render the contaminant levels in the product gas similar to those in natural gas. Nearly all particulate matter will be removed by the hot cyclone. Most metals will be sequestered in the char or removed with the particulate matter through the hot cyclone. Accordingly, the contaminant concentrations will be similar to the traditional fuel that it will replace. As noted, the treatment equipment will be monitored in accordance with an enforceable air permit to ensure contaminant levels remain within expected ranges.

IV. Conclusion

The proposed system processes the syngas produced from the electrically-powered pyrolysis of MSW feedstock to a quality similar to natural gas by removing condensables, particulates, metals, and sulfur. The gas will be used as a legitimate fuel in producing steam to provide indirect heat for the evaporation of leachate, offsetting the use of traditional fuels. As such, the process meets the intent of 40 CFR Part 241 and the syngas should be considered a non-waste fuel.

If you have any questions regarding this determination request, please contact the undersigned at 321-704-4162 or via email at jchristi@cecenv.com

Sincerely,

Jim Christiansen
Vice President/Sr. Project Director
Carlson Environmental Consultants, PC

cc: Mr. Johnny Poore, Lamar County Regional Solid Waste Authority
Mr. Eric Cornwell, Georgia Environmental Protection Division